Configuration Management Plan

Checkout and Launch Control Systems (CLCS)

84K00052

Agreements:

Original signed by ***Ralph Esposito***	*1/28/98*	***Original signed by*** ***Mark S. Dotterweich***	*1/28/98*
Project Manager, United Space Alliance CLCS	Date	Project Manager, LMSMS&S CLCS	Date
Original signed by ***Tom Fleming***	*1/28/98*	***Original signed by*** ***Kirk Lougheed***	*1/28/98*
Chief, Project Controls Office	Date	Chief, System Engineering and Integration Division	Date
Original signed by ***Dennis R. Fougnie***	*1/28/98*	***Original signed by*** ***Larry A. Wilhelm***	*1/28/98*
Chief, Subsystem Engineering Division	Date	Chief, System Software Division	Date
Original signed by ***Ben Bryant***	*1/28/98*	***Original signed by*** ***Retha Hart***	*1/28/98*
Chief, Application Software Division	Date	Project Manager, CLCS	Date

PREPARED BY: Vera Murphy Love, DP-1/PCO

Thomas Fleming, Chief, DP-1, PCO

Al Menendez, DNX-32

Betty Lopez, DNX-32

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Table of Contents

1. INTRODUCTION 1-1

1.1 PURPOSE 1-1
1.2 DEFINITION OF CONFIGURATION MANAGEMENT 1-1
1.3 SCOPE 1-2
1.4 EFFECTIVITY 1-2
1.5 AUTHORITY 1-2

2. RELATED DOCUMENTS 2-2

2.1 APPLICABLE DOCUMENTS 2-2
2.2 REFERENCE DOCUMENTS 2-3

3. CM ORGANIZATION & RESPONSIBILITIES 3-3

3.1 ORGANIZATION 3-4
3.2 RESPONSIBILITIES 3-4
3.2.1 Configuration Control Board (CCB) 3-5
3.2.2 Project Controls Office (PCO) 3-5
3.2.3 Developers 3-5
3.2.4 Integration and Test Group 3-5
3.2.5 Integration Control Panel (ICP) 3-5
3.2.6 Quality Assurance (QA) Section Roles & Responsibilities 3-6
3.2.7 Configuration Control (CC) Group 3-6

4. CM PROCESSES AND ACTIVITIES 4-7

4.1 CONFIGURATION IDENTIFICATION 4-8
4.2 CONFIGURATION AND CHANGE CONTROL 4-9
4.3 CLCS BASELINE RELEASE MANAGEMENT 4-9
4.4 CONFIGURATION AUDIT & ACCOUNTING 4-9
Appendix A -- Glossary A-1
A-2

CONFIGURATION MANAGEMENT PLAN

CHECKOUT AND LAUNCH CONTROL SYSTEMS (CLCS)

1. INTRODUCTION

1.1 PURPOSE

This Plan defines the Configuration Management (CM) program for the Checkout and Launch Control System (CLCS). The CLCS will replace the current Launch Processing System (LPS) with state-of-the-art technology, thereby ensuring Shuttle launch support that is as safe and reliable as possible, as well as providing the ability to support Shuttle upgrades and future advanced launch systems. The CLCS Project will rely heavily on the use of Commercial Off-the-Shelf (COTS) products to enhance its reliability, reduce development time and incorporate industry standards where possible.

This plan outlines the CLCS CM organization, responsibilities, activities and the configuration control flow to be managed by the CLCS Project Controls Office (PCO). Implementation of the provisions of this Plan and accompanying procedures are the responsibility of the entire CLCS project team.

1.2 DEFINITION OF CONFIGURATION MANAGEMENT

Configuration Management is the integrated methodology used to control the configuration or revision of specified items. When applied to a project, CM ensures control of development and deliverable products. Configuration control is implemented through proper storage of development products, version control, control of changes, and many other areas which are discussed in this plan. CM is also applied during operations to control the configuration at a facility. Operational CM is tailored to facilitate operational changes and everyday operation of the products under control.

Control of activities and products during a project entails four main areas of CM: Configuration Identification, Status Accounting, Configuration Control and Configuration Audit. Configuration Management is achieved by first establishing those items which will be configuration controlled (Configuration Identification) and controlling changes to those items (Configuration Control) during the project and operations. When items are identified as configuration controlled, they are said to be “Baselined”.

During the project, the Configuration Control Group (CC Group) can provide, at any time, a picture of the current configuration of any portion of the CLCS. A configuration picture is represented by the current baseline. The CC Group also provides the status of any change activities (Status Accounting). Further baseline discussions follow in this Plan.

Throughout project life, audits are conducted to ensure that the current configuration items derived from the project requirements meet those requirements. This audit is also known as an as-designed vs. as-built verification. This type of audit (Configuration Audit) is conducted to ensure that all changes that were made to requirements and other design documents are indeed reflected in the developing or developed product. The CC Group provides the baseline so that the products can be verified to meet what is represented in the baseline.

1.3 SCOPE

This plan is applicable to all CLCS development products, documents, software, firmware, test procedures and deliverable products. This plan defines CM activities including Configuration Identification, Configuration Control, Configuration Status Accounting, and Configuration Auditing of CLCS products. This plan also addresses Release Management and Software Change Control. Throughout the remainder of this document, the term software will refer to both software and firmware. Detailed CM procedures are contained in CLCS Procedures, 84K07500-001 through -005, which are referenced throughout this Plan.

1.4 EFFECTIVITY

This plan is effective upon signature approval and will remain in effect throughout the lifecycle of CLCS products (development, integration, installation, checkout, user acceptance, and interim operations). This plan is baselined and controlled by the CLCS Configuration Control Board (CCB) and revised as required.

1.5 AUTHORITY

This plan is developed to support the CLCS Configuration Management program, as authorized by the KSC Program Management Council (PMC). The PMC authorized the CLCS CCB to function as the change authority for the CLCS Project.

2. RELATED DOCUMENTS

2.1 APPLICABLE DOCUMENTS

Applicable documents are those documents whose contents are considered to form a part of this document. The specified parts of the applicable documents are as significant as if stated within the body of this document. These documents are:

- Configuration Identification Procedures Checklist (84K07500-001)
- Document Generation and Control Procedures (84K07500-002)
- Configuration and Change Control Procedures (84K07500-003)
- Baseline Release Procedures (84K07500-004)
- Configuration Audit and Accounting Procedures (84K07500-005)
- Documentation Tree (84K00000)
- Configuration Control Board (CCB) Charter (84K00006)

- System Engineering Management Plan (84K00053)
- Review Item Disposition (RID) Processing Document (84K0199-001)
- CM Tool Tutorials, URL: http://clcs.ksc.nasa.gov/cm (On-line tutorials, that shall have updates as refinements are made to CM Tool.)

2.2 REFERENCE DOCUMENTS

Reference documents are those documents which, although not a part of this document, serve to clarify its contents. The documents in this paragraph are provided as reference material. In case of conflict, this Configuration Management Plan will take precedence. These documents are:

- CLCS Software Development Plan (84K00054)
- Procedure for Preparation of Document Release Authorization, DE-P 720
- NASA Software Documentation Standard, NASA-STD-2100-91
- Quality Management – Guidelines for Configuration Management, ISO 10007
- Guidelines for Auditing Quality Systems, ISO 10011-1
- Quality Systems – Model for Quality Assurance in Design, Development, Production, Installation and Servicing, ANSI/ASQC Q9001-1994

3. CM ORGANIZATION & RESPONSIBILITIES

CM is managed by the PCO, and is implemented by all project technical personnel. Configuration management is administered by the project CC Group. The Systems Engineering and Technical Integration (SE&I) team has overall responsibility for the technical aspects of the CLCS Project and as such is responsible for managing the technical approach within the established technical baseline. The CCB controls this baseline, including all changes. This baseline is defined by CLCS Project Specifications, 84K00200, 84K00349, as well as by project budgets and development schedules.

3.1 ORGANIZATION

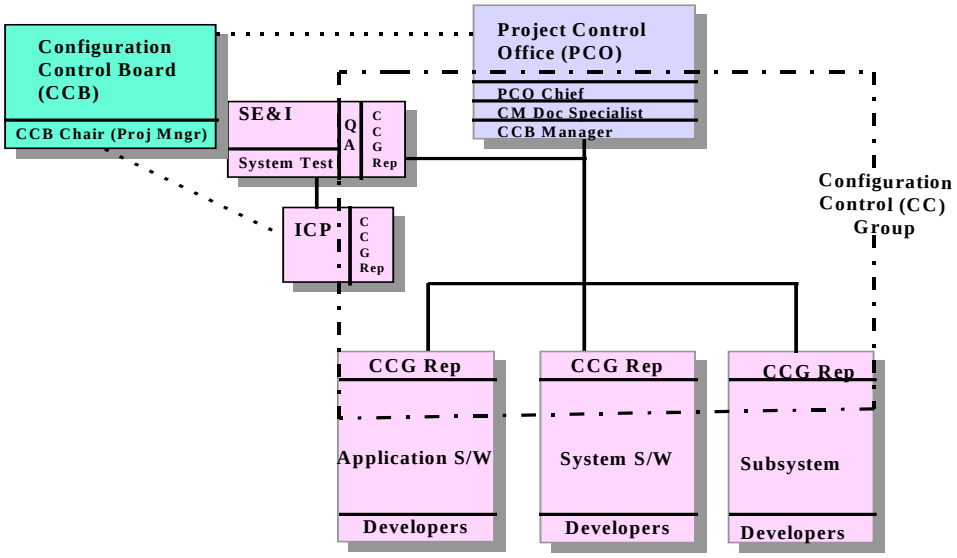

Figure 1 – CLCS Related CM Groups

Although CM is the responsibility of all organizations and individuals working on the project, the CLCS PCO has the overall responsibility for the project's CM program. Included in the PCO's responsibility, is conducting the CCB which is chaired by the Project Manager. The Integrated Control Panel (ICP), working under the organizational element of SE&I, has been authorized by the CCB to advise and act in its behalf in the CM of the project's developmental facilities.

The CC Group is composed of representatives from the PCO, SE&I, the ICP, Subsystem Engineering, and System and Application Software. Figure 1 illustrates the CLCS Related CM Groups.

Successful CM of software engineered by the project relies heavily on CM procedures being followed by developers from Subsystem Engineering, System and Application Software Divisions. Quality representatives support the project's CM program through the SE&I Division. Test plans and procedures are developed to support system integration and testing by the Integration and Test Group, also operating under the auspices of the SE&I Division.

3.2 RESPONSIBILITIES

Basic CM responsibilities are defined below. Additional specific responsibilities are listed in the CM Procedures and are part of the comprehensive steps for the CM activities discussed later in this Plan.

3.2.1 Configuration Control Board (CCB)

The responsibilities of the CCB are defined in detail in the CCB Charter (84K00006). General responsibilities include:

- Control the baseline of the CLCS Project hardware, software and documentation
- Establish and control CLCS release schedules
- Elevate to the Program Management Council (PMC) those changes which affect program level requirements or are not within budget or schedule

3.2.2 Project Controls Office (PCO)

General responsibilities for the PCO in regards to CM include:

- Ensure Configuration Management functions are established and implemented
- Monitor the compliance and implementation of the CM Plan and related procedures across the CLCS project
- Issue CLCS Documentation numbers
- Control Documentation through the CM Tool

3.2.3 Developers

General responsibilities for the Developers in regards to CM include:

- Support SE&I Change Package review and approval via formal assessment
- Implement approved baseline changes

3.2.4 Integration and Test Group (I&T Group)

The I&T Group functions under the SE&I element, and has the overall responsibility for coordinating and conducting integration, test, verification and validation. General responsibilities for the I&T Group in regards to CM include:

- Integrate and test CLCS products, including implemented baseline changes, in preparation for delivery to the user community
- Identify and document any nonconformance issues and problems with the as-designed baseline
- In conjunction with the CC Group, ensure that products to be released are built from controlled items in the CLCS Repository

3.2.5 Integration Control Panel (ICP)

The ICP has full authority to implement and maintain the CM of the development environments, in accordance with the approved procedures established by the ICP, and approved by the CCB. The ICP authority is granted by the CLCS CCB. This is further described in the ICP Charter, 84K00012.

The ICP will perform the following roles:

- Verify that the CLCS Issues priorities (low, medium, high, urgent) have been appropriately classified, the ICP will reclassify them if necessary.

- Review proposed fixes to Issues and forward the issue to the CCB with a technical recommendation, ESR, additional Issue, etc. if those fixes:
    - Cause significant changes to the system configuration
    - Significant Impact to the delivery schedule or delivery content
    - Require additional budget or resources for the delivery
    - Add, delete or modify approved System level requirements
- Review and approve the final closure of Formal CLCS Issues
- Review and approve changes to development lab environments

3.2.6 Quality Assurance (QA) Section Roles & Responsibilities

The QA Section shall review, witness and report the results all formal tests made to configuration controlled baselines. The role of the QA Section is further in the Safety and Mission Assurance Plan, 84K00055.

3.2.7 Configuration Control (CC) Group

The CC Group is chaired by the PCO Chief. Meetings are held as required. General responsibilities for the CC Group include:

- Assure the development, maintenance and distribution of plans and procedures for the execution of CM processes
- Coordinate impact of changes with CLCS users, affected developers, and CLCS management through the Engineering Assessment process
- Administer CLCS change documents' review and approval processes
- Support SE&I in the planning, identification, creation, and release of CLCS products to the CLCS user community, and ensure that products to be released are built from controlled items in the CLCS Library
- Administration and control of the CM Repository and associated records, safeguarding controlled elements and maintaining access
- Provide status of the current configuration of all CM aspects of the CLCS Project and the status of any change activities by performing the status accounting process to ensure that the configuration baseline and changes to it are captured and tracked
- Work with project management and the CCB to identify items to be placed under configuration control.
- Place all configuration controlled items into the CM Tool's Document Repository, and maintain original documents, all COTS versions, magnetic media, etc., in the CM Library
- Establish version control for all configuration controlled items and for all baselines throughout the project lifecycle.
- When directed, assemble a baseline for the specified documents and/or products
- Ensure that changes to all baselined items are controlled, and that items to be modified are accessed in a controlled manner to protect the integrity of the CLCS Baseline
- Ensure coordination of all changes to controlled products, ensure completeness of the change packages, and coordinate reviews of product baseline changes with project management and the CCB
- During software changes, support use of the CM Tool by the developers, providing assistance for check-in, check-out, and use of change documents

- Deliver the Delivery Packages to the appropriate documentation control and distribution center
- Provide necessary baselines to support configuration audits
- Maintain audit trails of all work products in each Delivery Package.

4. CM PROCESSES AND ACTIVITIES

The CM processes that are implemented on the CLCS Project are Configuration Identification, Configuration Control, Baseline Release Management, and Configuration Audit & Accounting. These CM activities occur during the entire project life cycle but are applied differently during different phases of the Project. Details on CM activities are documented in procedures. 84K07500-001, through -005. Each of these procedures are briefly discussed in this Plan. Figure 2 describes the CM Documented Procedures.

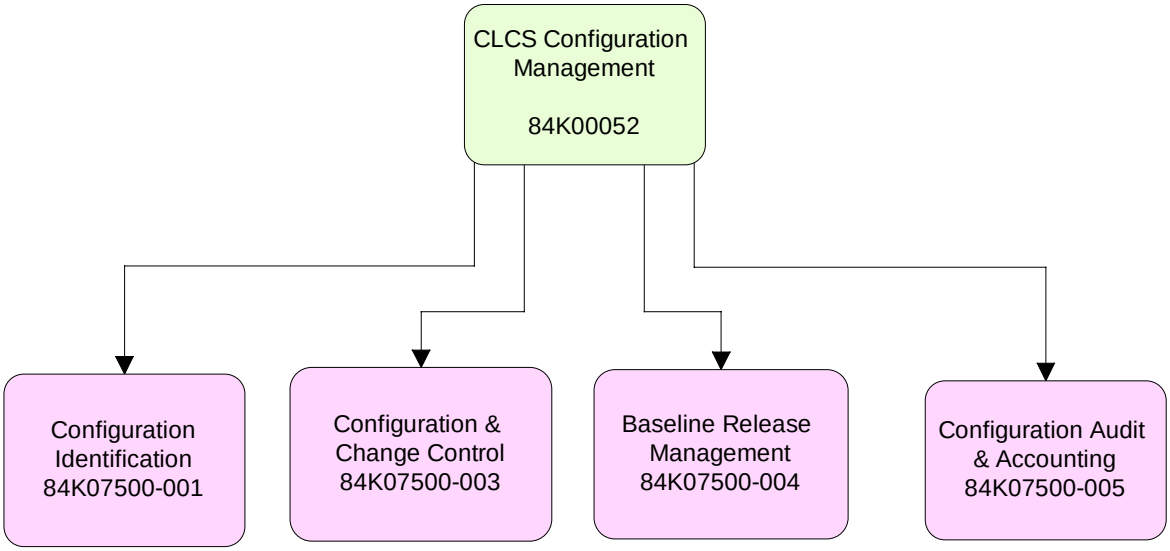

Figure 2 – CM Documented Procedures

Basic Project phases are development, testing and operations. Management and control of software and hardware will vary during the CLCS project duration. The applicable phases are given below.

Project phases for system software development are:

- CSCI Integrated Test (CIT)
- System Test
- Operations

Project phases for application software development are:

- Application Software Development
- User Integrated Verification
- Operations

Project phases for Hardware Development are:

- Hardware Integrated Test (HIT)
- System Test
- Operations

The appropriate CM procedures to be followed during each phase of the project are discussed in the Procedures, and are briefly addressed below.

In order to provide CM support to the CLCS, a variety of forms are used. These are listed and discussed below, as well as in the applicable Procedures.

4.1 CONFIGURATION IDENTIFICATION

Configuration Identification is the process of selecting project documentation and items of hardware and software that need to be placed under configuration control, and describing their baseline configurations in terms of technical documentation and hardware/software identifiers. The CC Group works with project management and the CCB to identify items to be placed under configuration control. Documentation numbers are issued by the PCO. The CC Group will place all configuration controlled items into the CM Tool's Document Repository, and maintain original documents, all COTS versions, magnetic media, etc., in the CM Repository

The CC Group will establish version control for all configuration controlled items and for all baselines throughout the project lifecycle. When new versions of configuration controlled items or baselines are generated, the CM tool will assign a new version number, and store the old version for ready access. A baseline is a snapshot of a configuration at a defined point in time. When directed, the CC Group shall assemble a baseline for the specified documents and/or products. The Baseline Release Form is used to direct the CC Group to assemble a Baseline. A more detailed definition can be referred to in the Configuration Identification Procedures Checklist, 84K07500-001.

The CLCS will establish a set of procedures to be followed when generating and delivering project documentation. Items such as the CLCS Document Tree, the CLCS document template, general drafting guidelines, storing your document in the CM Repository, and sending your document out for review are outlined in the Document Generation and Control Procedures (84K07500-002).

4.2 CONFIGURATION AND CHANGE CONTROL

Configuration and Change Control is defined as the proposal, justification, evaluation, coordination, approval or disapproval of proposed changes, and the implementation of all approved changes of a configuration controlled item. The intent is to ensure that only authorized changes are made to the baselined products and to communicate the fact that changes have been made.

Configuration Control involves maintaining the integrity and traceability of the configuration items throughout the CLCS system life cycle, from development to integration and on through maintenance. Change Control involves the systematic control of changes to the software and hardware configuration. The work products placed under the control of the CM group include the software products (including COTS), the hardware items, and the project documentation that are identified as required to create and operate the CLCS.

The CLCS CM group will ensure that changes to all baselined items are controlled, and that items to be modified are accessed in a controlled manner to protect the integrity of the CLCS Baseline. SE&I, delivery managers, and CLCS CM ensures that products to be released are built from controlled items in the CLCS Repository During the change process, the CLCS CM group ensures coordination of all changes to controlled products, ensures completeness of the change packages, and coordinates reviews of product baseline changes with the CLCS Project Management and the CLCS CCB. The CM Repository contains the software baselines as they are developed. The release of software products built from the CM Repository is addressed in the Baseline Release Procedures, 84K07500-003.

4.3 CLCS BASELINE RELEASE MANAGEMENT

A CLCS baseline release consists of any number or type of configuration controlled items as defined in the Delivery Process, KDP-P-1173-BASIC, and to be tracked by the Delivery Manager. It includes records for all items in the delivery as well as a list of any unresolved issues. The ICP is authorized to request a baseline and interim release pending approval from the CCB.

Each CLCS baseline release is documented in a delivery package. The package includes a list of associated issues and references the associated delivery document. The delivery package also lists the implemented changes, verification documentation, build instructions, installation instructions and operating instructions. Copies of each CLCS delivery package, and any other releases associated with that package, are kept in the CM Repository. Master copies of all media are stored in the CM Repository. Backup copies are stored in an off-site facility to protect against possible loss due to natural disasters or other events that may occur.

An interim package may be requested at any time during the project life-cycle. A detailed discussion of release procedures are discussed in the CLCS Baseline Release Procedures, 84K07500-004.

4.4 CONFIGURATION AUDIT & ACCOUNTING

Configuration Audits consist of an as-designed/as-built verification of the configuration items. The purpose of these audits are to compare the project requirements against the developing or completed product. The CLCS CC Group will provide necessary baselines to support configuration audits. CLCS CM maintains audit trails of all work products in each Delivery Package.

Configuration Accounting is conducted throughout the project life cycle to ensure that baseline changes are defined, properly recorded and processed. The CM function performs the status accounting process to ensure that the configuration baseline and changes to it are captured and tracked. This is achieved by recording, storing, maintaining, and reporting configuration data and status as required to support project needs.

The CC Group uses the CM Tool for status accounting. Status accounting reports will be generated once a week or as needed. Reports will be generated to show all change activities, and current status of change activities, for all phases and products of the CLCS project. The reports will be made available to all project management and development personnel, as requested. Procedures for conducting a Configuration Audit are contained in the CLCS Configuration Audit & Accounting Procedures, 84K00750-005.

Appendix A -- Glossary

AS-DESIGNED CONFIGURATION. The planned configuration identified by the approved baseline.

AS-BUILT CONFIGURATION. The actual configuration of the end product. It is usually audited against the approved baseline (configuration audit).

BASELINE. A configuration identification item or a set of items formally designated and fixed at a specific time during a life cycle. Baselines, plus approved changes to those baselines, constitute the current approved configuration identification.

BASELINE RELEASE. A Baseline Release is the term given to an assembly of configuration controlled items at a specific point in time, which are then released to the appropriate approved recipient(s).

CHANGE PACKAGE. The documentation which drives a change in configuration. Always accompanied by a change document.

CHANGE TRACKING. A function of configuration management in which modifications to the baseline are recorded and traced throughout their entire lifecycle.

CONFIGURATION. The functional and physical characteristics of hardware or software as set forth in technical documentation and achieved in a product.

CONFIGURATION AUDIT AND ACCOUNTING. The verification of a systems conformance between the as-designed system and the as-built system.

CONFIGURATION CONTROL. The systematic proposal, justification, evaluation, coordination, approval or disapproval of proposed changes, and implementation of all approved changes into the configuration of a CI after formal establishment of its initial configuration baseline.

CONFIGURATION IDENTIFICATION. The process of selecting end items of hardware and software to be under configuration control, describing their baseline configuration in terms of technical documentation and hardware/software identifiers, and the system for preparing, maintaining and releasing the configuration documentation.

CONFIGURATION MANAGEMENT. A discipline applying technical and administrative direction and surveillance to (a) identify and document the functional and physical characteristics of a configuration item, (b) control changes to those items, and (c) record and report change processing and implementation status.

CONFIGURATION MANAGEMENT (CM) REPOSITORY The repository where project documentation and system source code are controlled and archived.

CONFIGURATION STATUS ACCOUNTING. The recording and reporting of the approved configuration identification, the status of proposed changes to configuration, and the implementation status of approved changes.

DELIVERY PACKAGE. The complete package of deliverable items for each delivery of the CLCS, i.e., Juno, Redstone, Thor, etc.

NON CONFORMANCE. A condition of any article or material or service in which one or more characteristics do not conform to design and / or requirements. This includes failures, discrepancies, defects and malfunctions.

End